

REMARKS

**This amendment is filed concurrently and in conjunction with a REQUEST FOR CONTINUED EXAMINATION and the required fee for same**

This amendment involves changes to the claims and specification.

Appendix B attached hereto identifies the specific changes by brackets and underlining as prescribed by the PTO Rules of Practice.

As a result of this amendment, claims 23, 24, 27, 29, 30 and 36-41 are now in the application.

The objections to the previous amendments to page 10 of the specification have been noted. The new page 10 paragraphs submitted herewith are believed to correct the errors noted by the Examiner.

Further in the interest of definiteness, Applicant has added the chemical name for Ciba's Chimassorb 944 light stabilizer to the first paragraph on page 10 of the application. The chemical name was determined by accessing the Prototype International Data Centre (PIDC) project of the Center for Monitoring Research (CMR) sponsored by the U. S. Army Space and Missile Defense Command (SMDC). Attached hereto as **Exhibit A** is a 5-page document downloaded from the PIDC web site that sets forth the chemical structure and CAS designation for the Chimassorb 944 UV light stabilizer product sold by Ciba.

Also attached hereto as **Exhibit B** is a 2- page document downloaded from the internet web site of Novartis Corp. that shows that Ciba and Geigy were merged in 1992 to form Ciba-Geigy Ltd. Hence it is clear that Ciba Chimassorb 944 product identified in Exhibit A and the Geigy Chimassorb 944 product identified on page 10 of the instant application are one and the same. In this connection, it should be noted that first paragraph on the 4<sup>th</sup> page of Exhibit A states that the Chimassorb 944 product is a "sterically hindered amine light stabilizer", the same description as appears on page 10, first paragraph, of the instant application. On the basis of the foregoing, it is believed clear that the addition of the chemical name for the Chimassorb 944 product to page 10 of the



application does not add any new matter but merely renders more definite the composition of that product.

Applicant respectfully requests reconsideration of the rejection of claims 23, 24 and 27 under 35 U.S.C. 112, 2<sup>nd</sup> paragraph, as being indefinite, for the reasons noted hereinafter.

Regarding the objection to claim 23, it is believed that a claim is not rendered indefinite merely because it refers to a table or drawing. In Section 2173.05 of the MPEP it is indicated that reference to a specific figure or table is permissible where it is more concise to incorporate by reference rather than duplicating the same in the claim. It is believed that Applicant's reference to Tables I and II is reasonably necessary for conciseness and should not be considered as indefinite since the tables identify specific properties of the Surlyn™ 1705-1 zinc ionomer that is the basis for the exceptional results achieved by Applicant. In this connection, it is to be noted that the modules produced in accordance with the Invention exhibit no loss in electrical photovoltaic performance after 1000 hours of exposure to 85% RH/85°C damp heat and after 20 cycles of change of conditions between 85%RH/85°C and 0%RH/-40°C. **On information and belief, prior to this invention such results had not been achieved using an ionomer as an encapsulant.**

As hereby amended, claim 23 and 24 no longer use the terms "the properties" and "the preceding specification", and reference to the test methods has been eliminated from claim 27. Additionally, claim 27 has been amended to provide the units of measurement of the melt flow index. Hence the objections to those items have been rendered moot.

Concerning the objection to Tables I and II as being indefinite because of the phrase "typical values" and because of the reference to ASTM test methods, Applicant notes that those tables are based on information provided by DuPont, the manufacturer of the Surlyn®1705-1 ionomer, to persons skilled in the art of handling and plastic materials. As such the term "typical values" is not indefinite but is merely indicative of the nominal values (see for example, use of the term



"Nominal Values" in **Exhibit C** attached hereto). As for the reference to the test methods used to measure physical properties, the mere fact that there is a possibility of altering the tests over time does not render a claim indefinite because of reference thereto. The test methods referred to are those that were in effect as of the date of filing the instant application, and hence the reference to the test method should be accepted as a meaningful and adequate disclosure, particularly since the test methods are a matter of public information and the details of the test methods as of the date of filing the application may be ascertained even in the event that the specific parameters of the test methods were to change. Moreover, as of now, there is no evidence to suggest that the cited test methods have changed. Therefore the objection to the cited methods as being indefinite is not well founded and should be withdrawn.

For the foregoing reasons, Applicant submits that claims 23, 24 and 27 are free of indefiniteness, and the rejection under 35 U.S.C. 112 should be withdrawn.

Applicant further requests reconsideration of the rejection of claims 23, 24 and 27 under 35 U.S. C. 103(a) as being unpatentable over Hanoka '382 in view of Gonsiorawski et al '920, for the reasons set forth hereinafter. These claims have been amended to better define Applicant's invention.

Applicant concedes that Hanoka '382 discloses a module that comprises a transparent glass front support sheet and a back support sheet, a plurality of solar cells disposed between those sheets, and the use of a zinc ionomer as an encapsulant. Applicant further agrees with the Examiner that Hanoka '382 does not disclose solder using an acidic flux, an ionomer that absorbs no more than 0.3 wt. % water, and certain other physical properties that characterize the specific ionomer disclosed and used by Applicant. Applicant also concedes that Gonsiorawski '920 discloses use of Xersin 2005 solder paste with fluxing agent to improve aging properties of solar cell soldered connections.

However, Applicant disagrees with the Examiner's contentions that (1) the physical properties of Surlyn™ 1702 ionomer are so similar to the Surlyn™ 1705-1 ionomer as to have a similar water absorption property, and (2) that the Surlyn



1705-1 and 1702 ionomers are so similar as to be expected to function equivalently. For one thing, the two ionomers do not have identical properties. In this connection Applicant has submitted herewith as **Exhibit C** a 2-page document that sets forth the specific properties of the Surlyn™ 1702 ionomer for comparison with the properties of the Surlyn™ 1705-1 ionomer set forth in Tables I and II of this application. That comparison reveals that the two ionomers differ with respect to a number of different properties, notably Secant Modulus, Tensile Strength, Elongation @ Break TD, Melting Point and Melt Flow Rate.

For another thing, the behavior or performance of the 1705-1 ionomer as an encapsulant for solar cells cannot be predicted from the 1702 ionomer. The unpredictability of the behavior and performance is evidenced from the experience gained from use of the Surlyn™ 1601 ionomer referred to as an equivalent material in col. 8, line 15 of Hanoka '382. In this connection it is to be noted that Dr. Hanoka is a former employee of ASE Americas, Inc., the assignee of the instant application and use of the Surlyn™ 1601 ionomer was known prior to the Hanoka '382 invention, being disclosed, for example, in Hanoka et al, U.S. Patent No. 5,476,553 (assigned to ASE Americas, Inc.).

The Surlyn™ 1601 ionomer was found wanting by ASE Americas, Inc. as an encapsulant, with the result that it has continued to search for a better encapsulant. The result of that continued experimentation is the discovery that the use of Surlyn™ 1705-1 zinc ionomer as the cell encapsulant would permit the construction of improved photovoltaic modules as disclosed in the instant application.

Applicant submits that although Hanoka '382 suggests that the Surlyn™ 1702 and 1601 ionomers are equivalent, the fact that ASE Americas, Inc. abandoned the Surlyn™ 1601 ionomer in favor of the Surlyn™ 1705-1 ionomer is reason for concluding that since the 1705-1 ionomer has been proven to provide results not obtainable with the 1601 ionomer, there is no reasonable basis for predicting that it would be obvious to use the 1705-1 ionomer in place of the 1702 ionomer and/or that they would function equivalently. In this connection,



Applicant has submitted herewith as **Exhibit D** a 2-page document derived from DuPont and entitled "SURLYN® thermoplastic resin" that reveals that the properties of Surlyn™ ionomers can vary widely. Applicant submits that in view of the differences in properties between the Surlyn 1705-1 and the Surlyn 1702 products and the fact that **Exhibit D reveals that** the properties of Surlyn ionomers can vary widely, it is unreasonable and pure speculation to predict how a particular ionomer composition will behave as an encapsulant under the stressful environmental conditions encountered by solar cell modules in various installations and locations.

For the foregoing reasons, Applicant submits that product defined by claims 23, 24 and 27 is patentable over the prior art of record.

Applicant also requests reconsideration of the rejection of claims 29 and 30 as unpatentable over Hanoka '382, Gonsiorawski '920 and Hanoka '116. Applicant acknowledges that thin film cells are old. However, claims 29 and 30 depend from claim 27 and are believed to be allowable for the same reasons as claim 27..

New claims 36 and 37 are allowable for the same reasons as claim 27 from which they depend, and also because they include a specific UV light stabilizer and UV light absorber that are not disclosed or rendered obvious from the prior art of record. In this connection, it is to be noted that the selection of a UV light stabilizer and light absorber is more than a matter of choice – whether or not a selected light stabilizer and absorber will interact with one another, or whether such compounds will or will not adequately protect the encapsulant, cannot be predicted. Therefore, Applicant submits that the discovery that the particular stabilizer and absorber compounds listed in claims 36 and 37 will provide the desired results is not obvious and should not be dismissed without due consideration of the fact that modules made with this invention have proven to provide exceptional results when subjected to prescribed stress tests, as mentioned on page 14 of the instant application.



Claim 38 claims a module construction per se. It is believed to be patentable for the same reasons as claim 27.

Method claims 39-41 differ from rejected claims 31-34 in that claim 39 specifically identifies the composition of the encapsulant. Claim 39 is patentable because of the fact that use of the specific ionomer described therein is not disclosed or rendered obvious from any of the references cited against claims 31-34 or claims 23, 24 and 27.

Claims 40 and 41 are patentable for the same reasons as claim 39 and also because of their additional limitations.

Additionally Applicant submits that the invention defined by claims 39-41 is rendered patentable by the specific laminating temperature cited therein. That laminating temperature is not rendered obvious from the prior art of record. As noted previously, the laminating temperature is important because of the fact that the whole purpose of Applicant's invention is to avoid degradation of the ionomer. The higher the temperature to which an ionomer is heated, the greater the likelihood of thermal degradation of the ionomer. As noted on page 6, third paragraph of the application, use of a zinc based ionomer as disclosed in the present application permits the laminating process to be conducted under moderate level without any thermal degradation of the ionomer. In this connection, it is to be noted that although Hanoka suggests use of a zinc ionomer, he does not indicate that a zinc ionomer is to be preferred over a sodium ionomer. Moreover, what Hanoka fails to disclose, and what is addressed for the first time by this invention, is the fact that acidic flux reactions with ionomer encapsulants can shorten the useful life and reduce performance of photovoltaic modules, and also that such reactions can be substantially avoided or reduced to a negligible level by using a zinc ionomer as the encapsulant.

To summarize, Applicant's invention provides an unexpected and new result, namely, solar cell modules that have passed stress tests of 1000 hours at 85% relative humidity and 85°C damp heat, as well as 20 cycles of temperature humidity cycling with the temperature ranging from 85 C to -40°. Also, in addition



to showing no decreased electrical performance after such tests, the tested modules fully satisfy the safety criteria of the wet and dry high voltage withstand tests at 3600 volts as well as the insulation resistance criteria measured at 500 volts. These results have not been achieved previously with other ionomer encapsulants, and such results are not suggested by any of the prior art of record.

In view of the foregoing remarks, it is respectfully submitted that the claims now in the application define a patentable invention and should be allowed.

Prompt and favorable reconsideration is solicited.

Respectfully submitted

 2/27/03


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(name of attorney)

  
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## **APPENDIX B**

### **IN THE SPECIFICATION:**

Page 10 – please replace the first paragraph with the following new paragraph:

In accordance with the preferred embodiment of the invention, additives for mitigating UV-induced photo-oxidation are incorporated in the zinc ionomer. Preferably the additives are added in amounts ranging from about 0.3 to about 1.0 wt. % and consist of a UV light absorber in the form of Tinuvin 328, a product manufactured by Geigy Chemical Corporation of Ardsley, New York, which is believed to be 2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol, and a UV stabilizer in the form of [Chimasorb] **Chimassorb™ 944**, also a product manufactured by Geigy Chemical Corporation, which is identified by the manufacturer as a sterically hindered amine light stabilizer (commonly identified as HALS). **More specifically, Chimassorb™ 944 is believed to have the following composition:**  
**poly[ 6-[ (1, 1, 3, 3-tetramethylbutyl)amino]-1, 3, 5-triazine-2, 4-diyl] [2, 2, 6, 6-tetramethyl-4-piperidiny) imino]-1,6-hexanediyl [(2, 2, 6, 6-tetramethyl-4-piperidiny) imino] ]**.

Page 10 – replace the second paragraph with the following new paragraph:

Test specimens, each comprising two 0.010 inch thick layers of Surlyn 1705-1, modified with 0.3 wt % Tinuvin 328 and about 0.3 **[2t] wt. % [Chimasorb] Chimassorb 944**, disposed between and bonded to two sheets of glass, showed improved radiation transmission in the 400 to 800 nM wavelength region and, more importantly, the specimens resisted photo-oxidation and maintained their high transmission properties in that wavelength region without discernible color alteration after prolonged and intense radiation stress exposure. More specifically, the test specimens were made using two different glasses. In one case, the front and back glass sheets were Solatex II glass (a tempered solar grade glass). In



the other case, the two glass sheets were a borosilicate glass. Figs. 1 and 2 illustrate the radiation transmission curves for test specimens made with Solatex II glass and borosilicate glass respectively. It is clear that in both cases, the transmission property for each specimen after 8 months exposure to the test condition is virtually the same as what it was immediately after fabrication and before testing.



IN THE CLAIMS:

Please cancel claims 25, 26, 28, and 31-35.

Please amend claims 23 and 27 so that they, and the other previously filed claims, read as follows:

23. (Amended) In a photovoltaic module of the type having an array of electrically interconnected photovoltaic cells encapsulated between a transparent front support sheet and a back sheet by a light-transmitting [ionomer,] encapsulant, said front support sheet being made of a CeO-free glass that is transparent to radiation having a wave-length in the range of 400 to 800 nM and said photovoltaic cells being interconnected by conductors that have been soldered in place using an acidic flux, the improvement wherein said light-transmitting [ionomer] encapsulant is a zinc ionomer [having] that comprises an ethylene-methacrylic acid copolymer or an ethylene-acrylic acid copolymer and has the properties set forth in Tables I and II [of the preceding specification] , and further wherein said ionomer is combined with 0.3 to 1.0 wt. % of a UV light absorber and 0.3 to 1.0 wt % light stabilizer.

24. (Unamended) A photovoltaic module according to claim 23 wherein said zinc ionomer absorbs no more than about 0.3 wt % water.

27. Amended) A photovoltaic module that exhibits no loss in electrical photovoltaic performance after 1000 hours of exposure to 85% RH/85°C damp heat and after 20 cycles of change of conditions between 85%RH/85°C and 0%RH/-40°C, said module comprising a transparent front support sheet made of a CeO-fre glass that is transparent to radiati n having a wav - length in the range of 400 to 800 nM, a back sheet, an array of photovoltaic cells disposed between said front support sheet and said back sheet, a plurality of



electrical conductors extending between said cells, said electrical conductors being physically and electrically coupled to said photovoltaic cells by solder connections, and an [ionomer] encapsulant extending between and bonded to said front support sheet and said back sheet and surrounding and bonded to said cells and said conductors, characterized in that an acidic flux residue is present at one or more of said solder connections, and said [ionomer] **encapsulant** is a zinc ionomer that is **comprises an ethylene-methacrylic acid copolymer or an ethylene-acrylic acid copolymer and is combined with 0.3 to 1.0 wt. % of a compound that is a UV light absorber and 0.3 to 1.0 wt. % of a compound that is a UV light stabilizer, said zinc ionomer being** substantially inert with respect to reaction with said acid flux residue, and [has] **having** a melt flow index of 5.5 **dg/min.**, a [melting] **melt** point of 95°C, a Vicat softening point of 65°C, a freeze point of 61°C, a density of 0.95 **g/cc**, [and] an ultimate tensile strength of 5300 psi (MD) and 5100 psi (TD), [with said values being determined according to the ASTM test methods listed in Tables I and II, and absorbs a maximum of 0.3 wt. % water] **a secant modulus of 35,000 psi (MD) and 34,000 (TD), and a maximum water absorption of 0.3 wt. %.**

29. (Unamended) A photovoltaic module according to claim 27 wherein said photovoltaic cells are thin film photovoltaic cells that are coupled to one another by monolithic connections.

30. (Amended) A photovoltaic module according to claim [27] **29** characterized by cadmium telluride or CIGS photovoltaic cells.

**PLEASE ADD THE FOLLOWING NEW CLAIMS:**

36. A photovoltaic module according to claim 27 wherein said UV light stabilizer is 2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol.



37. A photovoltaic module according to claim 36 wherein said UV light absorber is poly[ 6-[ (1, 1, 3, 3-tetramethylbutyl)amino]-1, 3, 5-triazine-2, 4-diyl] [2, 2, 6, 6-tetramethyl-4-piperidiny) imino]-1,6-hexanediy [(2, 2, 6, 6-tetramethyl-4-piperidiny) imino] ].
38. A photovoltaic module that exhibits no loss in electrical photovoltaic performance after 1000 hours of exposure to 85% RH/85°C damp heat and after 20 cycles of change of conditions between 85%RH/85°C and 0%RH/-40°C, said module comprising a transparent front support sheet made of glass that is transparent to radiation having a wave-length in the range of 400 to 800 nM, a back sheet, an array of photovoltaic cells disposed between said front support sheet and said back sheet, a plurality of electrical conductors extending between said cells, said electrical conductors being physically and electrically coupled to said photovoltaic cells by solder connections, and an ionomer encapsulant extending between and bonded to said front support sheet and said back sheet and surrounding and bonded to said cells and said conductors, characterized in that an acidic flux residue is present at one or more of said solder connections, and said ionomer is a zinc ionomer that comprises a copolymer of ethylene-methacrylic acid or a copolymer of ethylene-acrylic acid, is substantially inert with respect to reaction with said acid flux residue, and has the following properties: a melt flow index of 5.5 dg/min., a melt point of 95°C, a freeze point of 61°C, a Vicat softening point of 65°C, a density of 0.95 g/cc, an ultimate tensile strength of 5300 psi (MD) and 5100 psi (TD), a secant modulus of 35,000 psi (MD) and 34,000 (TD), and a maximum water absorption of 0.3 wt. %.
39. A method of manufacturing a photovoltaic module comprising the steps of:
- (a) providing one or more strings of electrically interconnected photovoltaic cells, each photovoltaic cell having a front light-receiving surface and a rear surface with first and second contacts attached to said front and rear surfaces



respectively, and said photovoltaic cells being interconnected by conductors that have been soldered in place using an acidic flux;

(b) providing front and back support sheets with said front support sheet being made of transparent CeO-free glass;

(c) providing at least one sheet of an encapsulating material comprising a zinc ionomer and 0.3 to 1.0 wt. % of a UV light absorber and 0.3 to 1.0 wt. % of a UV light stabilizer, said zinc ionomer comprising an ethylene-methacrylic acid copolymer or an ethylene-acrylic acid copolymer and having the following properties: a melt flow index of 5.5 dg/min., a melt point of about 95°C, a freeze point of 61°C, a Vicat softening point of 65°C, a density of 0.95 g/cc, an ultimate tensile strength of 5300 psi (MD) and 5100 psi (TD), a secant modulus of 35,000 psi (MD) and 34,000 (TD), and a maximum water absorption of 0.3 wt. %;

(d) placing said at least one sheet of encapsulating material in overlying relation with one surface of said front support sheet;

(e) placing said one or more strings of photovoltaic cells in overlying relation with at least one sheet of encapsulating material;

(f) placing a sheet of scrim in overlying relation with said one or more strings of photovoltaic cells;

(g) covering said sheet of scrim with one or more additional sheets of said encapsulating material;

(h) placing said back support sheet in overlying relation with said one or more additional sheets of said encapsulating material;

(i) heating the resulting assembly of said front and back support sheets, said sheets of said encapsulating material and said one or more strings of photovoltaic cells to a temperature in the range of about 120°C to about 130°C and compressing said components together under a pressure in the range of about 390 to about 400 torr, so as to cause said sheets of encapsulating material to soften enough to encapsulate said photovoltaic cells and conductors; and



(j) cooling said assembly so as to cause said encapsulating material to form a solid bond to said photovoltaic cells, conductors, scrim and front and rear support sheets, whereby to produce a laminated module.

40. A method according to claim 39 wherein said UV light stabilizer is 2-(2H-benzotriazol-2-yl)-4, 6-ditertpentylphenol.

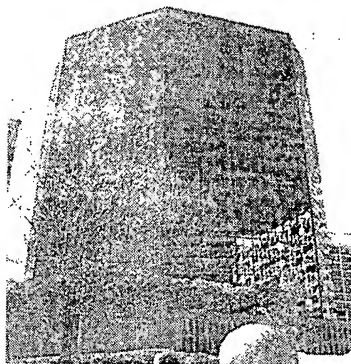
41. A method according to claim 40 wherein said UV light absorber is poly[ [6-[ (1, 1, 3, 3-tetramethylbutyl)amino]-1, 3, 5-triazine-2, 4-diyl] [2, 2, 6, 6-tetramethyl-4-piperidiny) imino]-1,6-hexanediy [(2, 2, 6, 6-tetramethyl-4-piperidiny) imino] ].



EXHIBIT A

#8  
Attach

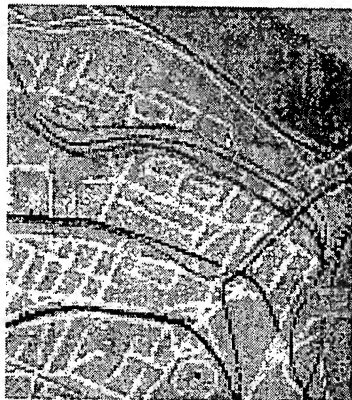
## About CMR



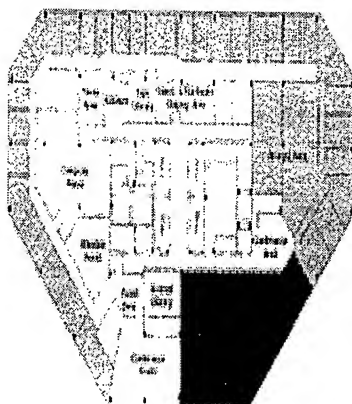
### CMR

Center for Monitoring Research

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Arlington, Virginia 22209  
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## CMR

**Welcome to the Center for Monitoring Research (CMR)** sponsored by the U. S. Army Space and Missile Defense Command (SMDC).

The CMR supports a wide range of efforts in the area of nuclear explosion monitoring through in-house research and development, and contractor support. Seismic, hydroacoustic, infrasonic, and radionuclide technologies are all utilized in the effort to improve the capability for monitoring the globe for nuclear explosions.

The CMR technical staff includes scientists, software engineers, and experts in information systems. Their capabilities, which range from data collection, analysis, and distribution to basic research and development, contribute to the various projects of the CMR.

The CMR Research and Development Support System (RDSS) project is focussed on improving the verification monitoring capability by supporting the DTRA R&D community, providing testing at appropriate scales for evaluating current and future capability, and focusing attention on the important technical issues.

The CMR hosted the Prototype International Data Centre (PIDC) as it was developed and delivered to the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) International Data Centre (IDC) in Vienna, Austria. The data obtained and products generated during the PIDC project (January, 1995 through September 2001) are available through the PIDC link on this site.

The CMR is located in Arlington, Virginia. Please click here for directions and site-specific information.



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## Documents

- **IDC Documentation** These Documents, which were produced as part of the Prototype International Data Centre project, describe the design and operation of the International Data Centre monitoring system.
- **CCB Minutes and Proposals** These documents describe changes to the operational system during and after operation of the PIDC. These changes were reviewed and approved by the Configuration Control Board (CCB).
- **CMR Document Library** - This library contains reference information for documents produced by nuclear monitoring related contracts funded by DTRA and other agencies (e.g. Air Force Geophysics Laboratory, Air Force Office of Scientific Research, etc.).
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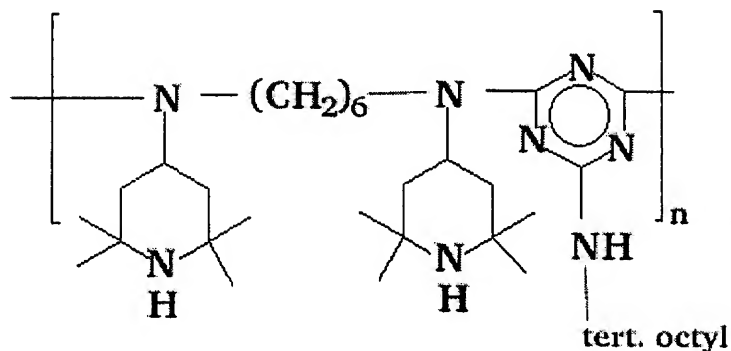


# Ciba-944

- CHIMASSORB 944 FD is an oligomeric, sterically hindered amine light stabilizer for plastics. Its applications include polyolefins, olefin copolymers such as EVA and polypropylene-elastomer blends. The performance of the product in cross-linked polyethylene is particularly noteworthy. In addition to polyolefins, CHIMASSORB 944 FD was found in certain instances to be highly effective in PPE blends, polyacetals, polyamides, polyurethanes, flexible and rigid PVC, as well as in PVC blends. Furthermore, this light stabilizer is effective in certain styrenic, elastomer and adhesive specialty applications. The effectiveness of CHIMASSORB 944 FD surpasses significantly that of UV-absorbers and Ni-stabilizers, particularly in pigmented systems. Combinations of CHIMASSORB 944 FD with UV absorbers of the TINUVIN or CHIMASSORB range can result in synergistic effects. Because of its oligomeric structure with an average molecular weight of approx. 3000, it is the light stabilizer of choice for all applications calling for low volatility and minimal migration, e.g. films and fibers. Furthermore, CHIMASSORB 944 FD is effective as antioxidant and, thus, contributes significantly to the long term heat stability of polyolefins and tackifier resins. The following properties of CHIMASSORB 944 FD deserve special mention:
- the substrate's color and transparency are not affected.
  - high compatibility with the above mentioned substrates.
  - easy dispersibility.
  - its high molecular weight and high thermal stability prevent volatilization and decomposition even at elevated temperatures.
  - broad approval for use in polyolefin food packaging.
  - free-flowing, dust free product form; easy handling and feeding.
- CHIMASSORB 944 FD can be readily incorporated into the polymers using conventional techniques. A limited number of masterbatches with CHIMASSORB 944 FD is available.



## Chemical Structure



## CAS Designation

Poly[[6-[(1,1,3,3-tetramethylbutyl)amino]-1,3,5-triazine-2,4-diyl]  
[(2,2,6,6-tetramethyl-4-piperidiny)imino]-1,6-hexanediy[(2,2,6,6-  
tetramethyl-4-piperidiny)imino]]

CAS NO. 71878-19-8

## Physical Properties

### Appearance

light yellow pellets, dust free

### Particle size

approx. 1-2 mm diameter

### Softening range

100-135°C

### Density

0.98g/cm<sup>3</sup> at 20°C

### Specific heat

1600 Joules kg/deg at 20°C

### Solubility at 20°C

### wt percent

hexane	40
benzene	>50
acetone	>50
ethyl acetate	>50
chloroform	>50
methylene chloride	3
water	<0.01

## Handling and Safety

CHIMASSORB 944 FD should be handled in accordance with good



industrial  
practice.

## ● Materials for Food Packaging

CHIMASSORB 944 FD is regulated in many countries for use in numerous packaging materials for food. For detailed information refer to our Positive List.

## ● Application

Extensive test results obtained in a variety of polymers and applications are available.

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[\[Application for ADK STAB additives\]](#) [\[Liba-770\]](#) [\[Liba-Tninvin-p\]](#)



EXHIBIT B

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I→ Help



Geigy, Ciba and Sandoz (1758-1970) | History | Geigy, Ciba and Sandoz (1758-1970)

## Geigy, Ciba and Sandoz (1758-1970)

I→ Ciba-Geigy and Sandoz (1970-1996)

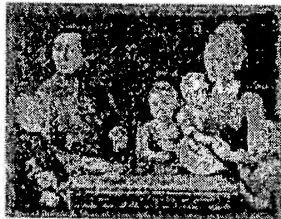
I→ Novartis (1996-present)

## How it all begun

## Geigy

1758

Johann Rudolf Geigy-Gemuseus (1733-1793) begins trading in "Materials, Chemicals, Dyes and Drugs of all Kinds" in Basel.



1857

Johann Rudolf Geigy Merian (1830-1917), together with Johann Müller-Pack acquires a site in Basel, where he builds a dyewood mill and a dye extraction plant. Only two years later, they begin the production of synthetic Fuchsine.

1898

Foundation of production site in Grenzach, Germany.

1901

Transformation into a public limited company, and in 1914 the name of the company is changed to J.R. Geigy Ltd.

1920

Foundation of the "Geigy Colour Company Ltd." in Manchester, and three years later a plant in Huningue, France.

1925

Production of textile

## Ciba

1859

Alexander Clavel (1805-1873) takes up the production of Fuchsine in his factory for silk dyeing works in Basel. In 1864 a new site for the production of synthetic dyes is constructed, and in 1873 Clavel sells his dye factory to the new company Bindschedler & Busch.



1876

Commercial representations of Bindschedler & Busch exist in Germany, France, England, Italy, Russia and the US.

1884

Transformation of Bindschedler & Busch into a joint-stock company with the name "Gesellschaft für Chemische Industrie Basel" (Company for Chemical Industry Basel). The abbreviation "Ciba" becomes so widespread that it is adopted as the company's name in

## Sandoz

1886

The Chemical Company Kern & Sandoz is set up in Basel by Dr. Alfred Kern (1850-1893) and Edouard Sandoz (1853-1928). The first dyes produced are alizarin blue and auramine.



1895

Production of the first pharmaceutical substance, antipyrine, a fever-controlling-agent. The partnership is transformed into a joint-stock company "Chemische Fabrik vormals Sandoz".

1899

First diversification into sweetening agents; start of saccharin-production.

1917

Creation of the Pharmaceutical Department by Prof. Arthur Stoll (1887-1971) and start of pharmaceutical research.

1918

Arthur Stoll isolates Ergotamin from the corn-fungus ergot. It is introduced under the trade-name Gynergen in 1921.



auxiliaries, which is taken up in 1928 by Ciba.

#### 1935

Production of insecticides. Ciba takes up its activities in this field in 1954.

#### 1938

Creation of a pharmaceutical department.

#### 1939

Production in the new plant of Schweizerhalle. Paul Müller, a Geigy researcher, discovers the insecticidal efficacy of DDT; for this work he receives the Nobel prize in 1948.



#### 1949

The anti-rheumatic drug Butazolidin is the first major drug.

#### 1956

Introduction of the first triazine-based herbicides (Simazine, Atrazine).

#### 1958

Introduction of Tofranil and its first successes in the area of psychotropic drugs.

#### 1959

Introduction of the first long-lasting diuretic Hygroton for the treatment of high bloodpressure.

#### 1963

Introduction of anti-epileptic Tegretol.

#### 1945.

#### 1900

Production of first pharmaceutical substances, Vioform, an antiseptic drug, and Salen, an anti-rheumatic agent.

#### 1908

Acquisition of a production site in Monthey, Switzerland. In 1911 first factories are founded in England (Clayton), Italy (Milan) and in 1915, in Russia (Moscow) and Germany (Berlin).

#### 1918

Creation of the "Interessengemeinschaft Basel" (Basler IG), a pooling agreement between Sandoz, Ciba and Geigy. In 1950 the Basler IG is disbanded.

#### 1924

Coramine, a circulatory drug, is synthesized in Ciba laboratories.

#### 1928

Take over of Geigy's production of textile auxiliaries.

#### 1946

The epoxy resin Araldite is introduced into the adhesive market.

#### 1954

Production of insecticides.

#### 1963

Desferal, a breakthrough product for the treatment of iron and aluminium overload in connection with the blood disease thalassaemia, is introduced.

#### 1929

Introduction of Calcium Sandoz, a breakthrough-product that lays the foundation for modern calcium therapy. The Chemicals Department (chemicals for textiles, leather and paper) is set up.

#### 1939

First steps into Agribusiness; the first product developed is the pesticide Copper Sandoz, introduced in 1943.

#### 1958

Introduction of the neuroleptic drug Melleril, a milestone in the history of psychotropic pharmaceuticals.

#### 1963

Acquisition of Biochemie GmbH in Kundl/Austria; large scale production of antibiotics and substances developed on the basis of biotechnology.

#### 1964

First research center outside Switzerland in East Hanover (NJ, USA), followed by the Sandoz Research Institute in Vienna, Austria, in 1970 and the Sandoz Institute for Medical Research in London in 1985.

#### 1967

Merger with Wander Ltd. and diversification into the dietetics business (Ovaltine, Isostar), followed by the acquisition of Delmark in 1972, Wasa, the Swedish crisp bread producer, in 1982 and Gerber Babyfood in 1994.

#### 1970

Ciba and Geigy merge to form Ciba-Geigy Ltd. In 1992, the company is renamed Ciba in line with the introduction of a new logo.

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EXHIBIT C  
IDES

Friday, October 11, 2002

**Surlyn® 1702**

DuPont Packaging &amp; Industrial Polymers - Ionomer

**Product Characteristics**

<b>Material Status</b>	
Availability	<ul style="list-style-type: none"> <li>• Commercial: Active</li> <li>• North America</li> <li>• Europe</li> </ul>
Test Standards Available	<ul style="list-style-type: none"> <li>• ASTM</li> </ul>
Recycled Content	<ul style="list-style-type: none"> <li>• No</li> </ul>
Features	<ul style="list-style-type: none"> <li>• Abrasion Resistance, Good</li> <li>• Clarity, High</li> <li>• Stiffness, Good</li> <li>• Toughness, Low Temperature</li> <li>• Heat Sealability, Low Temp.</li> <li>• Adhesion, Good</li> </ul>
Uses	<ul style="list-style-type: none"> <li>• Film</li> <li>• Packaging, Food</li> <li>• Pharmaceuticals</li> <li>• Packaging, Medical</li> </ul>
Agency Ratings	
Forms	<ul style="list-style-type: none"> <li>• FDA 21 CFR 177.1330 <sup>1</sup></li> </ul>
Processing Method	<ul style="list-style-type: none"> <li>• Pellets</li> <li>• Coextrusion</li> <li>• Extrusion Coating</li> </ul>

**Physical****Properties <sup>2</sup>**

	Nominal Values (English)	Test Method
Density - Specific Gravity	0.950 sp gr 23/23°C	ASTM D792
Melt Flow Rate (190°C/2.16 kg - E)	14.0 g/10 min	ASTM D1238
<b>Films</b>		
	Nominal Values (English)	Test Method
Film Thickness	2.0 mil	
Secant Modulus MD (1% Strain)	34000 psi	ASTM D882
Secant Modulus TD (1% Strain)	30000 psi	ASTM D882
Tensile Strength @ Brk MD	3600 psi	ASTM D882
Tensile Strength @ Brk TD	3300 psi	ASTM D882
Elongation @ Break MD	350 %	ASTM D882
Elongation @ Break TD	350 %	ASTM D882
Dart Drop Impact	300 gm	ASTM D882
Elmendorf Tear Str MD	170 gm	ASTM D1709
Elmendorf Tear Str TD	190 gm	ASTM D1922
Water Vapor Transmission	0.70 g/100 in <sup>2</sup> /day	ASTM D1922
		ASTM E96

**Thermal**

	Nominal Values (English)	Test Method
Vicat Softening Point	149 °F	
Melting Point	199 °F	ASTM D1525

**Optical**

	Nominal Values (English)	Test Method
Haze	2.0 %	ASTM D1003

**Additional Properties**

Ion Type: Zinc

**Extrusion Molding Parameters****Processing Information**

	Nominal Values (English)	Test Method
Cylinder Zone 1 Temp.	325 °F	
Cylinder Zone 2 Temp.	375 °F	



Cylinder Zone 3 Temp.	425 °F
Cylinder Zone 4 Temp.	450 °F
Cylinder Zone 5 Temp.	450 °F
Melt Temperature	425 to 500 °F
Die Temperature	450 °F

#### Notes

- <sup>1</sup> When used unmodified for the manufacture of food contact articles, Surlyn® 1702 will comply with Food Additive Regulations FDA 21 CFR 177.1330 under the U.S. Food, Drug and Cosmetic Act. Such uses are subject to good manufacturing practices and any other limitations which are part of the statute or regulations. These should be consulted for complete details.
- <sup>2</sup> Typical properties; not to be construed as specifications.



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The information presented on this data sheet was acquired by IDES from various sources, including the producer of the material and recognized testing agencies. In some cases, material updates have been integrated directly into the IDES i-Centric Database by the material producer utilizing the IDES i-Manage Suite™ Data Maintenance Tool. IDES makes substantial efforts to assure the accuracy of this data. However, IDES assumes no responsibility for the data values and urges that upon final material selection, data points are validated with the manufacturer.



## Product Information

## Product and Properties Overview



# Surlyn®

thermoplastic resins

## Basic Description

DuPont *Surlyn*® brand resins are unique ionomer-class molding and extrusion materials created from DuPont proprietary acid copolymers. Starting with selected molecular weight grades of copolymers such as ethylene/methacrylic acid, DuPont adds zinc, sodium, lithium or other metal salts. Acid neutralization results in the formation of ion clusters (hence the general term, "ionomer") within the resulting polymer matrix.

*Surlyn*® resins are designed and manufactured by DuPont to deliver premium end-use performance or processing characteristics in a variety of specialized industrial applications.

## Performance Features

*Surlyn*® resins incorporate many of the performance features of the original ethylene-based copolymers, such as chemical resistance, melting range, density, and basic processing characteristics. However, *Surlyn*® resin performance is significantly enhanced in such areas as:

- low temperature impact toughness;
- abrasion/scuff resistant

- chemical resistance;
- transparency/clarity
- melt strength;
- direct adhesion of epoxy and polyurethane finishes; and
- direct adhesion to metal, glass, and natural fibers by heat lamination.

## Product Range

DuPont offers a wide selection of *Surlyn*® resins, starting with base resins of varying molecular weight. Proprietary manufacturing technologies allow precise control of acid levels and the degree of acid neutralization occurring with each metal ion type in each resin grade. This precision control enables DuPont to manufacture each grade of its *Surlyn*® product line with high lot-to-lot consistency and end-use reliability.

More than 30 grades of *Surlyn*® currently are available commercially for molding and industrial applications. The range of properties for these resins are shown in Table 1.

Table 1. Selected Properties of *Surlyn*®

Property	Value Range	Test Method
Specific Gravity	0.94 - 0.97	ASTM D 792
Hardness (Shore D)	36 - 68	ASTM D 2240
Flex Modulus (room temp, kpsi)	4.3 - 75	ASTM D790 Procedure B
Tensile Strength (kpsi)	2.3 - 5.4	ASTM D 638
Elongation at Break (%)	285 - 770	ASTM D 638
→ Melt Flow Index (g/10 min.)	0.7 - 20.0	ASTM D 1238
Vicat Softening Point (°C)	47 - 74	ASTM D 1525-70
Melting Point (°C)	70 - 100	DSC*
Freeze Point (°C)	38 - 75	DSC*
Optical Haze (0.25 in.(6.4 mm))	1.3 - 27	ASTM D1003A

\*As determined by differential scanning calorimetry



## For More Information

Complete properties for individual grades of *Surlyn*® thermoplastic resins for molding and industrial extrusion can be found on DuPont's web site.

DuPont technical staff are also available via e-mail and by mail, fax or telephone.

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### DuPont Worldwide

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The technical data contained herein are guides to the use of DuPont resins. The advice contained herein is based upon tests and information believed to be reliable, but users should not rely upon it absolutely for specific applications because performance properties will vary with processing conditions. It is given and accepted at user's risk and confirmation of its validity and suitability in particular cases should be obtained independently. The DuPont Company makes no guarantees of results and assumes no obligations or liability in connection with its advice. This publication is not to be taken as a license to operate under, or recommendation to infringe, any patents.

**CAUTION:** Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see DuPont Medical Caution Statement, H-50102.



**Surlyn®**  
Only by DuPont